

Brookhaven National Laboratory Sewage Treatment Plant

Facility Environmental Monitoring Report

Calendar Year 2000



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**Brookhaven National Laboratory
Sewage Treatment Plant
Facility Environmental Monitoring Report
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***Summary of Results:** There were eight reported SPDES permit exceedances during CY 2000. Zinc concentrations in the STP discharge exceeded permit limits on four occasions. There were also single permit exceedances for tetrachloroethylene, fecal coliform (average and maximum), iron and total suspended solids removal efficiency.*

Groundwater monitoring results indicate only low-level impacts to groundwater quality from STP operations. Sodium levels slightly exceeded water quality standards in several wells that monitor the STP filter bed area. Low levels of nitrates and tritium were also detected, but at concentrations below applicable water quality standards. No volatile organic compounds were detected in groundwater near the plant.

Environmental TLD measurements indicate that dose rates in the vicinity of the STP are equivalent to natural background values.

Background

The STP processes sanitary sewage for BNL facilities. The STP processes an average of 0.72 million gallons per day (MGD) during non-summer months and approximately 1.25 MGD during the summer months. Treatment of the sanitary waste stream includes: primary clarification to remove settleable solids and floatable materials; aerobic oxidation for secondary removal of the biological matter and nitrification of ammonia; secondary clarification; sand filtration for final effluent polishing; and, ultraviolet disinfection for bacterial control prior to discharge into the Peconic River. By regulating the oxygen levels during the treatment process, nitrogen can be biologically removed by using nitrate bound oxygen for respiration. This discharge is regulated under a NYSDEC SPDES permit (NY-0005835).

Wastewater from the STP's clarifier is released to the sand filter beds, where the water percolates through three feet of sand before being recovered by an underlying clay tile drain system, which transports the water to the discharge point at the Peconic River (SPDES Outfall 001). Approximately 15% of the water released to the filter beds is either lost to evaporation or to direct groundwater recharge. At the present time, six sand filter beds are used in rotation.

Two emergency hold-up ponds are located to the east of the sand filter bed area. The hold-up ponds are used for the emergency storage of sanitary waste in the event of an upset condition or if the influent contains contaminants in concentrations exceeding BNL administrative limits and/or SPDES permit effluent release criteria. The hold-up ponds are equipped with fabric reinforced (hypalon) plastic liners that are heat-welded along all seams. The first lined hold-up pond was constructed in 1978, and has a capacity of approximately four million gallons. A second four million gallon capacity lined pond was constructed in 1989, for a combined capacity of nearly eight million gallons. The combined capacity of the hold-up ponds provides the Laboratory with the ability to divert all sanitary system effluent for approximately twelve days. As part of Phase III Sewage Treatment Plant Upgrades project, the liners will be enhanced by the addition of new primary liners and a leak detection system. The existing liners will be used as secondary liners.

Environmental Monitoring Program

BNL has established an environmental monitoring program at STP to evaluate potential impacts to environmental quality and to demonstrate compliance with DOE requirements and applicable federal, state and local laws, regulations and permits. The primary monitoring program is conducted in accordance with BNL's SPDES permit. BNL also uses groundwater monitoring to provide a secondary means of evaluating potential impacts of STP operations. The environmental monitoring program for the STP is described in the BNL Environmental Monitoring Plan (Daum *et al.* 2000; BNL, 2001). The monitoring programs specifically designed for the STP area are summarized below.

Monitoring Results

SPDES Monitoring

Sanitary and process wastewaters generated by Laboratory operations are conveyed to the STP for treatment prior to discharge to the Peconic River. The STP provides tertiary treatment of sanitary and process wastewater (i.e., biological reduction of organic matter and reduction of nitrogen). This treatment process became fully functional in 1998.

The locations of SPDES monitoring points are presented on Figure 1. A summary of the CY 2000 monitoring results for the STP discharge at Outfall 001 is provided in Table 1.

While the STP discharge complies with SPDES permit limits more than 95% of the time, periodic excursions are noted annually. During 2000 there were eight reported exceedances. Zinc concentrations in the STP discharge exceeded permit limits on four occasions, two in May and two in December. Zinc excursions continue into CY 2001. Although a definitive source of zinc has not been identified to date, a potential source may be the sewage piping system upgrade project that started in late 1999. This project involves the removal of roots and cleaning of the lines, and in damaged areas

replacement or relining the pipes with a fiberglass sleeve. Experimental and operational sources are also being reviewed to ensure wastewater is being properly managed at the source. These investigations continue. Single exceedances for tetrachloroethylene (PCE), fecal coliform (average and maximum), iron and total suspended solids (TSS) removal were also reported for the year. Iron was attributed to excavations being performed in the STP sand filters and the excursion for TSS was accounted for by low concentrations of suspended solids in the influent to the STP. While PCE is monitored several times monthly, it is not routinely reported to the NYSDEC as part of the BNL discharge monitoring report submittals. However, when a sample collected in June exhibited a concentration of 31 µg/L, a report was submitted to the NYSDEC. (Note: The New York State Ambient Water Quality Standard for PCE is 5 µg/L. PCE is routinely used in commercial cleaners and over-the-counter spot removers.) PCE has not been detected in STP effluent over the last five years (1995-1999). The detection of this compound is suspected of being a false positive result. Similarly, a positive result for fecal coliform is suspected of being the result of cross contamination. Inspection of the ultraviolet light disinfection system showed it to be fully operational.

Groundwater

The STP's groundwater monitoring program is designed to provide a secondary means of verifying that STP operations are not impacting environmental quality. Six wells are used to monitor groundwater quality in the filter bed area and three wells are monitored in the holding pond area (Figure 2). Groundwater monitoring results for CY 2000 indicate only low-level impacts to groundwater quality from STP operations.

Radiological Analyses: Radioactivity levels in samples collected from the STP wells were generally typical of ambient (background) levels (Table 2). Tritium was not detected in wells located in the immediate filter bed area. Low-levels of tritium (up to 2,500 pCi/L) were detected in Well 039-88 (up to 2,500 pCi/L) and Well 039-89 (up to 799 pCi/L) located downgradient of the holding ponds. Because the ponds have not been used recently to hold tritiated waste water and the wells are also located downgradient of the filter bed area, it is likely that the tritium originated from past water releases to the filter beds. An elevated gross alpha concentration of 94.7 pCi/L was detected in the June sample from Well 039-88. This value exceeds the 15 pCi/L drinking water standard. However, gross alpha was not detected in the sample collected from this same well in December. Historical gross alpha measurements in groundwater at the STP have generally been <3 pCi/L, well below the 15 pCi/L standard. It is likely that the elevated gross alpha concentration in the June sample is due to an erroneous measurement or sample cross contamination. If future STP groundwater samples indicate elevated gross alpha, BNL will conduct radionuclide-specific analyses to identify possible alpha emitting radionuclides.

Non-radiological Analyses: During CY 2000, all water quality and most metals concentrations were below the applicable New York State Ambient Water Quality (NYS AWQS) (see Tables 3 and 4). Sodium was detected at concentrations slightly above the

NYS AWQS of 20 mg/L in three filter bed area wells. Wells 039-07, 039-08 and 039-86 had maximum sodium concentrations of 22.3 mg/L, 30 mg/L and 29.2 mg/L, respectively. Nitrates were detected in most STP area wells, with a maximum concentration of 9.9 mg/L detected in filter bed area monitoring Well 039-08. The NYS AWQS for nitrate is 10 mg/L. Volatile organic compounds were not detected in any of the monitoring wells.

Environmental TLDs

Measurements of environmental background radiation are conducted through a network of onsite and offsite environmental TLDs. The TLDs allow for the measurement of radiation from cosmic and terrestrial sources, as well as any contribution from Laboratory operations. One of the TLDs 038-450 is located at the STP (Figure 3). TLD data are collected from this monitoring location on a quarterly basis. The ambient dose rates for the four quarters were 21, 19, 18, and 22 mrem, respectively. The dose rates were similar to normal background rates found in the area.

Future Monitoring Actions

It is recommended that:

- SPDES monitoring program will continue per permit requirements.
- Maintain the groundwater monitoring program on its current semiannual schedule.
- Continue the TLD monitoring program on its current schedule.

References

BNL, 2001. Brookhaven National Laboratory Environmental Monitoring Plan, CY 2001 Update (January 2001). BNL-52584 Update.

Daum, M., Dorsch, W., Fry, J., Green, T., Lee, R., Naidu, J., Paquette, D., Scarpitta, S., and Schroeder, G., 2000. Brookhaven National Laboratory, Environmental Monitoring Plan 2000 (March 31, 2000).

BNL Facility Environmental Monitoring Report
Sewage Treatment Plant
SPDES Monitoring Program
Table 1

| Analyte | Min. | Max. | Min. Monitoring Frequency | SPDES Limit | No. of Exceedances | Percent Compliance* |
|--|-------------|-------------|----------------------------------|--------------------|---------------------------|----------------------------|
| Max. Temperature (°F) | 52 | 77 | Daily | 90 | 0 | 100 |
| | | | | | | |
| pH (SU) ⁽¹⁾ | 5.8 | 7.7 | Cont. Recorder | Min. 5.8 | 0 | 100 |
| | | | | Max. 9.0 | | |
| | | | | | | |
| Avg. 5 day Biological Oxygen Demand (BOD) (mg/L) | < 2 | 5 | Twice Monthly | Avg. 10 | 0 | 100 |
| | | | | | | |
| | | | | | | |
| Max. 5 day BOD (mg/L) | < 2 | 8 | Twice Monthly | Max. 20 | 0 | 100 |
| | | | | | | |
| % BOD Removal | > 83 | 97 | Monthly | 85 | 0 ⁽²⁾ | 100 |
| | | | | | | |
| Avg. Total Suspended Solids (TSS) (mg/L) | < 4 | < 4 | Twice Monthly | Avg. 10 | 0 | 100 |
| | | | | | | |
| | | | | | | |
| Max. TSS (mg/L) | < 4 | < 4 | Twice Monthly | Max. 20 | 0 | 100 |
| | | | | | | |
| % TSS Removal | > 73 | 99 | Monthly | 85 | 1 ⁽³⁾ | 92 |
| | | | | | | |
| Settleable Solids (ml/L) | 0.0 | 0.0 | Daily | 0.1 | 0 | 100 |
| | | | | | | |
| Ammonia Nitrogen (mg/L) | < 0.05 | 1.1 | Twice Monthly | 2 | 0 | 100 |
| | | | | | | |

| | | | | | | |
|------------------------------|----------|--------|---------------|-------------------|------------------|-----|
| Total Nitrogen (mg/L) | 5.8 | 8.0 | Twice Monthly | 10 | 0 | 100 |
| | | | | | | |
| Total Phosphorus (mg/L) | 0.4 | 1.5 | Twice Monthly | NA ⁽⁴⁾ | 0 | 100 |
| | | | | | | |
| Cyanide (µg/L) | < 10 | < 10 | Twice Monthly | 100 | 0 | 100 |
| | | | | | | |
| Copper (mg/L) | 0.04 | 0.06 | Twice Monthly | 0.15 | 0 | 100 |
| | | | | | | |
| Iron (mg/L) | 0.01 | 0.5 | Twice Monthly | 0.37 | 1 ⁽⁵⁾ | 96 |
| | | | | | | |
| Lead (mg/L) | < 0.001 | 0.005 | Twice Monthly | 0.019 | 0 | 100 |
| | | | | | | |
| Nickel (mg/L) | 0.003 | 0.01 | Twice Monthly | 0.11 | 0 | 100 |
| | | | | | | |
| Silver (mg/L) | 0.001 | 0.006 | Twice Monthly | 0.015 | 0 | 100 |
| | | | | | | |
| Zinc (mg/L) | 0.01 | 0.15 | Twice Monthly | 0.1 | 4 ⁽⁶⁾ | 86 |
| | | | | | | |
| Mercury (mg/L) | < 0.0001 | 0.0002 | Twice Monthly | 0.0008 | 0 | 100 |
| | | | | | | |
| Toluene (µg/L) | < 1 | < 1 | Twice Monthly | 5 | 0 | 100 |
| | | | | | | |
| | | | | | | |
| Methylene Chloride (µg/L) | < 1 | < 1 | Twice Monthly | 5 | 0 | 100 |
| | | | | | | |
| 1,1,1-Trichloroethane (µg/L) | < 1 | < 1 | Twice Monthly | 5 | 0 | 100 |
| | | | | | | |
| 2-Butanone (µg/L) | < 1 | < 5 | Twice Monthly | 50 | 0 | 100 |
| | | | | | | |
| PCBs (µg/L) | < 0.065 | 0.053 | Quarterly | NA | 0 | 100 |

| | | | | | | |
|---|-----|-----|----------------|----------|------------------|-----|
| | | | | | | |
| Max. Flow (MGD) | 0.6 | 1.9 | Cont. Recorder | Max. 2.3 | 0 | 100 |
| | | | | | | |
| Avg. Flow (MGD) | 0.5 | 0.7 | Cont. Recorder | NA | 0 | 100 |
| | | | | | | |
| Avg. Fecal Coliform (MPN/100 | < 2 | 451 | Twice Monthly | 200 | 1 ⁽⁸⁾ | 96 |
| | | | | | | |
| Max Fecal Coliform (MPN/100 ml) ⁽⁷⁾ | < 2 | 900 | Twice Monthly | 400 | 1 ⁽⁸⁾ | 96 |

* % Compliance = [(Total No. Samples – Total No. Exceedances) / Total No. of Samples] x 100

(1) SU = Standard Unit

(2) The calculated BOD percent removal was greater than 83 percent in November. The 5-day BOD results were below the analytical detection limit and therefore the actual percent removal cannot be precisely determined.

(3) A permit violation occurred in April due to low levels of solids entering the sewage treatment plant. STP effluent levels of suspended solids were below the permit limits. The February percent removal could not be accurately determined due to the low concentration measured in the influent and effluent to the sewage treatment plant.

(4) NA = Not Applicable

(5) A permit violation occurred in June of 2000. An investigation revealed that the Plant Engineering Division had performed tests within the sand filter beds at the Sewage Treatment Plant during the last part of May. The filter beds contain elevated levels of iron and therefore this is the most probable cause of the permit violation.

(6) There were permit violations in May and December of 2000. The December 2000 violations are most probably due to sewer cleaning being performed onsite during November and December.

(7) MPN = Most Probable Number

(8) A permit violation occurred in January of 2000. In 1997 the Sewage Treatment Plant was equipped with an ultraviolet disinfection system, which results in low to non-detect levels of coliform in the effluent. It is therefore thought that the violation is due to dirty glassware.

Other: A permit violation occurred in June of 2000 at the STP effluent for tetrachloroethylene. The Laboratory's SPDES permit does not allow the discharge of this chemical in any concentration.

BNL Facility Environmental Monitoring Report
Sewage Treatment Plant
Groundwater Monitoring Program
Gross Alpha, Gross Beta, Tritium and Gamma Spectroscopy Results for CY 2000
Table 2

| Well | Sample Period | Gross Alpha (pCi/L) | Gross Beta (pCi/L) | Tritium (pCi/L) | Potassium-40(c) (pCi/L) |
|-------------|------------------|------------------------------|------------------------------|------------------------------|----------------------------------|
| 038-02 a | June December | 1.5 +/- 0.69 1.9 +/- 0.64 | 3.8 +/- 1.3 <2.5 | <295 <290 | ND 30.5 +/- 21.4 |
| 038-03 a | June December | <1.0 <0.8 | 22.7 +/- 1.9 16.0 +/- 1.8 | <295 <346 | ND 32.3 +/- 23.0 |
| 039-07 a | June December | <1.0 <0.8 | 2.9 +/- 1.3 <2.5 | <295 <290 | ND ND |
| 039-08 a | June December | <1.0 <0.8 | 4.2 +/- 1.3 <2.5 | <295 <290 | 34.2 +/- 28.2 44.0 +/- 22.2 |
| 039-86 a | June December | 2.9 +/- 0.7 <0.8 | 4.6 +/- 1.5 <2.5 | <309 <290 | 202 +/- 87.8 35.3 +/- 25.5 |
| 039-87 a | June December | 1.5 +/- 0.6 0.9 +/- 0.5 | 7.4 +/- 1.6 6.5 +/- 1.6 | <309 <346 | ND ND |
| 039-88 b | June December | 94.7 +/- 3.5 (d) <0.8 | 20.8 +/- 1.9 <2.5 | 2,500 +/- 320 748 +/- 216 | 217.0 +/- 211.7 35.8 +/- 21.9 |
| 039-89 b | June December | <0.9 <0.8 | <2.3 <2.5 | 799 +/- 250 304 +/- 203 | ND ND |
| 039-90 b | June December | <0.9 0.8 +/- 0.5 | <2.3 <2.5 | <309 <290 | ND 24.2 +/- 21.5 |
| Typical MDL | | 1.1 | 2.2 | 300 | -- |
| SDWA Limit | | 15 | 50 | 20,000 | 280 |

a: Well is located near STP Filter Beds.

b: Well is located immediately downgradient of STP Holding Ponds. Well is also nominally downgradient of the STP filter bed area.

c: Potassium-40 is a naturally occurring radionuclide. Other, naturally occurring radionuclides may have been detected in some samples (e.g., Bi-214, Pb-212, and Pb-214).

d: Accuracy of the gross alpha result for this sample is suspect.

Note: SDWA Limit is based upon 40 CFR 141 Safe Drinking Water Act

ND = Radionuclide not detected.

MDL = Minimum Detection Limit.

**BNL Facility Environmental Monitoring Report
Sewage Treatment Plant
Groundwater Monitoring Program
Water Quality Results for CY 2000**

Table 3

| Well | Sample Period | Chlorides (mg/L) | Sulfates (mg/L) | Nitrate (mg/L) |
|-------------|----------------------|-------------------------|------------------------|-----------------------|
| 038-02a | June | 10.6 | 10.0 | 4.8 |
| | December | 4.9 | 9.3 | 5.5 |
| 038-03a | June | 6.4 | 19.5 | <1.0 |
| | December | <4.0 | 16.3 | 1.4 |
| 039-07a | June | 15.8 | 8.5 | 3.4 |
| | December | 24.9 | 9.8 | 6.1 |
| 039-08a | June | 19.7 | 14.0 | 9.9 |
| | December | 26.0 | 17.2 | 7.0 |
| 039-86a | June | 22.2 | 16.8 | 5.2 |
| | December | 25.7 | 12.5 | 6.3 |
| 039-87a | June | 8.0 | 11.9 | 2.1 |
| | December | 4.1 | 14.4 | 1.2 |
| 039-88b | June | 4.5 | 16.4 | 2.1 |
| | December | <4.0 | 17.1 | 1.5 |
| 039-89b | June | 5.1 | 13.9 | 1.6 |
| | December | <4.0 | 11.5 | 1.6 |
| 039-90b | June | 5.1 | 11.9 | 2.0 |
| | December | 5.1 | 14.3 | <1.0 |
| Typical MDL | | 4.0 | 4.0 | 1.0 |
| NYSAWQS | | 250 | 250 | 10 |

MDL: Minimum Detection Limit

a: Well is located near STP Filter Beds.

b: Well is located immediately downgradient of STP Holding Ponds. Well is also nominally downgradient of the STP filter bed area.

**BNL Facility Environmental Report
Sewage Treatment Plant
Groundwater Monitoring Program
Metals Analytical Results for CY 2000
Table 4**

| Well | Sample Period | Ag (mg/L) | Al (mg/L) | Cd (mg/L) | Cr (mg/L) | Cu (mg/L) | Fe (mg/L) | Hg (mg/L) | Mn (mg/L) | Na (mg/L) | Pb (mg/L) | Zn (mg/L) |
|-------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 038-02 a | June | 0.018 | 0.008 | <0.001 | 0.002 | <0.002 | <0.075 | 0.0002 | <0.002 | 10.5 | 0.0013 | <0.004 |
| | December | <0.001 | 0.011 | <0.001 | <0.001 | <0.002 | <0.075 | <0.0001 | <0.002 | 8.4 | <0.0013 | <0.004 |
| 038-03 a | June | <0.001 | 0.046 | <0.001 | 0.002 | <0.002 | <0.075 | 0.0003 | <0.002 | 5.8 | 0.0013 | <0.004 |
| | December | <0.001 | 0.019 | 0.001 | <0.001 | 0.006 | <0.075 | <0.0001 | 0.057 | 3.2 | <0.0013 | 0.298 |
| 039-07 a | June | <0.001 | 0.012 | <0.001 | 0.002 | 0.085 | <0.075 | 0.0002 | 0.015 | 14.0 | <0.0013 | 0.021 |
| | December | <0.001 | 0.006 | <0.001 | <0.001 | 0.003 | <0.075 | <0.0001 | 0.004 | 22.3 | <0.0013 | 0.009 |
| 039-08 a | June | <0.001 | 0.021 | <0.001 | 0.002 | 0.030 | <0.075 | <0.0002 | <0.002 | 28.0 | <0.0013 | <0.004 |
| | December | <0.001 | 0.012 | <0.001 | <0.001 | 0.014 | <0.075 | <0.0001 | <0.002 | 30.0 | <0.0013 | <0.004 |
| 039-86 a | June | <0.001 | 0.020 | <0.001 | 0.002 | 0.025 | <0.075 | 0.0002 | 0.067 | 29.2 | <0.0013 | <0.004 |
| | December | <0.001 | 0.019 | <0.001 | <0.001 | 0.003 | <0.075 | <0.0001 | 0.052 | 26.3 | <0.0013 | <0.004 |
| 039-87 a | June | <0.001 | 0.035 | <0.001 | <0.001 | 0.003 | <0.075 | <0.0002 | 0.017 | 5.6 | <0.0013 | 0.218 |
| | December | <0.001 | 0.030 | <0.001 | <0.001 | <0.002 | <0.075 | <0.0001 | 0.019 | 4.7 | <0.0013 | 0.050 |
| 039-88 b | June | <0.001 | 0.018 | <0.001 | <0.001 | <0.002 | <0.075 | 0.0003 | 0.008 | 4.5 | <0.0013 | <0.004 |
| | December | <0.001 | 0.012 | <0.001 | <0.001 | <0.002 | <0.075 | <0.0001 | 0.007 | 3.7 | <0.0013 | <0.004 |
| 039-89 b | June | <0.001 | 0.096 | <0.001 | <0.001 | <0.002 | <0.075 | 0.0004 | 0.085 | 3.4 | <0.0013 | 0.035 |
| | December | <0.001 | 0.078 | <0.001 | <0.001 | <0.002 | <0.075 | <0.0001 | 0.040 | 2.8 | <0.0013 | 0.008 |
| 039-90 b | June | <0.001 | 0.009 | <0.001 | <0.001 | <0.002 | <0.075 | 0.0003 | 0.005 | 4.9 | <0.0013 | 0.006 |
| | December | <0.001 | 0.005 | <0.001 | <0.001 | <0.002 | <0.075 | <0.0001 | 0.003 | 6.6 | <0.0013 | <0.004 |
| Typical MDL | | 0.001 | 0.002 | 0.001 | 0.001 | 0.002 | 0.075 | 0.0002 | 0.002 | 1.0 | 0.001 | 0.004 |
| NYSAWQS | | 0.05 | 0.1 | 0.01 | 0.05 | 0.2 | 0.3 | 0.0007 | 0.3 | 20 | 0.025 | 0.3 |

Note: Primary potential contaminants shown. Other metals were analyzed for – see database for complete data set

MDL: Minimum Detection Limit

NA: Not analyzed for.

a: Well is located near STP Filter Beds.

b: Well is located downgradient of STP Holding Ponds.

